

monthly ranges are: Eastport, Maine, 2°.4; San Francisco, California, 3°.3; and 5° at Jacksonville, Florida, New London, Connecticut, and Provincetown, Massachusetts.

Temperature of Water for September, 1888.

STATION.	Temperature at bottom.		Range.	Average depth, feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City, New Jersey.....	70.7	64.5	6.2	3 6	65.1
Alpena, Michigan.....	65.7	47.3	18.4	12 6	52.8
Augusta, Georgia.....	85.0	74.0	11.0	4 6	73.8
Baltimore, Maryland.....	75.0	66.0	9.0	10 0	65.1
Block Island, Rhode Island.....	66.5	58.9	7.6	8 6	61.5
Boston, Massachusetts.....	62.8	60.5	2.3	21 6	59.3
Buffalo, New York.....	69.3	57.0	12.3	10 4	57.5
Cedar Keys, Florida.....	89.1	78.5	10.6	11 3	79.9
Charleston, South Carolina.....	81.6	72.1	9.5	41 0	74.3
Chicago, Illinois.....	67.7	58.0	9.7	8 6	60.7
Chincoteague, Virginia.....	79.0	64.0	15.0	5 9	67.5
Cleveland, Ohio.....	70.5	60.8	9.7	14 0	59.5
Detroit, Michigan.....	70.0	58.8	11.2	23 2	59.7
Delaware Breakwater, Delaware.....	72.2	65.3	6.9	8 6	66.7
Duluth, Minnesota.....	59.3	50.1	9.2	15 5	54.6
Eastport, Maine.....	50.9	48.5	2.4	15 11	55.3
Escanaba, Michigan.....	64.0	53.0	11.0	16 7	53.3
Galveston, Texas.....	85.0	72.0	13.0	11 1	79.3
Grand Haven, Michigan.....	71.6	57.1	14.5	19 0	57.0
Indianola, Texas.....	86.5	73.6	12.9	8 7	78.2
Jacksonville, Florida.....	84.0	79.0	5.0	18 0	76.5
Key West, Florida.....	88.8	83.0	5.8	17 8	82.9
Mackinaw City, Michigan.....	64.7	54.3	10.4	12 0	54.2
Fort Macon, North Carolina.....	82.5	69.0	13.5	8 5	72.8
Marquette, Michigan.....	58.0	49.0	9.0	9 10	53.9
Milwaukee, Wisconsin.....	64.4	56.0	8.4	8 0	56.9
Mobile, Alabama.....	89.0	79.5	9.5	16 4	77.9
New Haven, Connecticut.....	69.7	61.4	8.3	15 1	60.1
New London, Connecticut.....	68.0	63.0	5.0	13 3	61.1
New York City.....	70.6	63.8	6.8	17 4	63.1
Norfolk, Virginia.....	75.1	66.9	8.2	17 7	70.5
Pensacola, Florida.....	84.7	77.2	7.5	17 2	77.2
Portland, Maine.....	57.8	52.5	5.3	18 3	59.2
Portland, Oregon.....	61.6	56.3	5.3	55 6	61.2
Provincetown, Massachusetts.....	64.0	59.0	5.0	12 2	60.8
Sandusky, Ohio.....	70.0	57.3	12.7	10 11	61.2
Sandy Hook, New Jersey.....	69.4	63.5	5.9	2 0	64.3
San Francisco, California.....	61.5	58.2	3.3	39 2	62.1
Savannah, Georgia.....	81.3	75.8	5.5	11 10	74.8
Smithville, North Carolina.....	83.3	69.4	13.9	10 0	72.4
Toledo, Ohio.....	73.7	60.3	13.4	12 3	66.6
Wilmington, North Carolina.....	79.6	69.0	10.6	21 3	72.1

* No observations taken from 8th to 26th, inclusive. Instrument broken.
† No observations taken from 19th to 23d, inclusive. Instrument broken.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Auroral displays were frequent during the month. Those of the nights of the 15th and 16th were the most extensively observed. The various displays have been reported, as follows:

Duluth, Minnesota, 2d: an auroral display was observed here from 8.30 to 11.30 p. m. It consisted of pale yellow light, with luminous beams, reaching an altitude of from twenty to thirty degrees above the horizon.

Saint Vincent, Minnesota, 2d: A faint auroral light was visible here from 8 p. m. to midnight.

Escanaba, Michigan, 2d: Aurora from 9 to 11 p. m., first appearing as a pale green light and later assuming the form of a double arch.

Eastport, Maine, 2d: A brilliant aurora, of pale yellow color, was observed from 7.30 p. m. to midnight. Faint streamers appeared between 7.50 and 8.20 p. m.

This display was also noted at Traverse City and Lansing, Michigan; Embarrass, Wisconsin, and at Gardiner, Maine.

Mackinaw City, Michigan, 3d: a brilliant auroral display was observed at 8.25 p. m., extending across the heavens from east to west. The display faded away at 9.50 p. m., and reappeared at 10.10 p. m., finally disappearing at 11.20 p. m.

On the 4th a faint display was observed at numerous points from Dakota eastward to Michigan. It was also observed as a faint display at Cambridge, Massachusetts.

On the 5th an auroral display was quite generally observed in New England and the lake region; it was observed as far westward as northern Dakota; the most southerly station reporting it was Moorestown, New Jersey.

Wentworth, Dakota, on the 7th.

Johnson, Nebraska, on the 8th.

Polo, Illinois, on the 9th and 10th.

Saint Vincent, Minnesota, 13th.

On the 15th, a display was reported by numerous stations in Montana; the limits of observation extending eastward to Dakota, westward to Washington Territory, and southward to Cheyenne, Wyoming.

At Helena, Montana, it was observed at 9 p. m., as a diffuse light, which gradually extended and increased in brilliancy until a complete corona was formed. The display ended at 9.40 p. m.

The display of the 16th was observed at scattering stations from the north Pacific coast to the lake region.

At Fort Canby, Washington Territory, it was observed at 7.45 p. m., consisting of three dark-red slender columns, gradually decreasing in brilliancy until 9 p. m., when they disappeared.

At Fort Maginnis, Montana, the auroral beams extended to the zenith.

Milwaukee, Wisconsin, 16th: at 7.30 p. m. an auroral light of pale straw color covered the northern sky with beams extending to an altitude of 85°.

Marquette, Michigan, 16th: a brilliant aurora was observed here at 7.10 p. m., consisting of luminous waves of light shooting up from every part of the northern sky, forming a perfect corona, which continued a few minutes, when it spread over the sky. The colors were varied and very beautiful. The display ended at 9.20 p. m.

Other auroral displays were reported by the following stations:

18th.—Fort Buford, Dakota; Saint Vincent, Minnesota; and Holton, Kansas.

21st.—Milwaukee, Wisconsin.

22d.—Fort Totten, Dakota.

23d.—Chambersburg, Pennsylvania.

24th.—Fort Buford, Bismarck, and Alexandria, Dakota; and Wilkesbarre, Pennsylvania.

25th.—Eastport, Maine; Point Judith, Rhode Island; Cleveland, Ohio; Alpena, Escanaba, and Traverse City, Michigan; Polo and Riley, Illinois; Dubuque, Iowa; Wentworth and Fort Totten, Dakota.

26th.—Escanaba, Michigan; Toledo, Ohio; Wentworth, Dakota; and Saint George's, Delaware.

THUNDER-STORMS.

Thunder-storms were reported in the various districts on the following dates:

New England.—12th, 17th, 18th, 24th, 27th to 30th.

Middle Atlantic states.—2d, 4th, 5th, 12th, 15th, 17th, 18th, 24th, 28th, 29th, 30th.

South Atlantic states.—3d, 4th, 5th, 10th, 13th to 19th, 23d, 24th, 27th, 30th.

Florida peninsula.—1st to 4th, 6th, 7th, 8th, 17th, 18th, 20th, 21st, 25th, 29th.

Eastern Gulf.—4th, 12th, 13th, 15th, 16th, 17th, 20th, 22d, 29th.

Western Gulf.—2d to 8th, 14th, 15th, 16th, 20th, 29th, 30th.

Tennessee.—2d to 5th, 9th, 16th, 18th to 23d, 30th.

Ohio valley.—2d, 3d, 4th, 7th, 8th, 16th, 19th to 24th, 28th, 29th, 30th.

Lower lakes.—2d, 4th, 16th, 20th to 24th, 29th, 30th.

Upper lakes.—1st, 4th, 6th, 7th, 9th, 15th, 16th, 20th to 24th, 27th, 28th, 29th.

Upper Mississippi valley.—1st, 2d, 4th to 8th, 10th, 13th, 15th, 16th, 20th, 22d, 23d, 24th, 29th, 30th.

Missouri valley.—1st, 5th, 6th, 7th, 10th, 12th to 15th, 18th, 19th, 20th, 23d, 29th, 30th.

Northern slope.—1st, 3d, 4th, 5th, 7th, 9th, 11th, 12th, 13th, 19th.

Middle slope.—1st to 9th, 12th to 15th, 17th, 18th, 21st, 30th.

Southern slope.—4th, 5th, 8th, 11th, 13th, 16th, 19th, 29th, 30th.

Southern plateau.—6th to 9th, 11th, 18th, 19th, 27th, 28th, 29th.

Thunder-storms were also reported from the following stations not included in the districts named above:

- 4th.—Roseburg and Albany, Oregon.
5th.—Roseburg, Oregon, Fort Lapwai, Idaho, and Salt Lake City, Utah.
6th.—Salt Lake City, Utah.
10th.—Fort Totten, Dakota, and Nephi, Utah.
12th.—Fort Buford, Dakota.
18th.—Los Angeles, Poway, and San Diego, California.
19th.—Poway, California.
21st.—Carson City, Nevada.
30th.—Nephi, Utah.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos have been observed in the various districts on the following dates:

New England.—6th, 10th, 11th, 12th, 15th, 17th, 19th to 22d, 24th, 28th.

Middle Atlantic states.—5th, 6th, 8th, 10th, 11th, 14th, 16th, 18th to 21st, 28th.

South Atlantic states.—11th, 15th, 18th, 21st, 28th.

Western Gulf.—5th, 6th, 7th, 9th, 14th, 15th, 19th, 20th, 27th, 28th.

Tennessee.—7th, 8th, 13th, 16th, 28th.

Lower lakes.—12th, 16th, 19th, 20th, 28th.

Middle Slope.—9th, 15th, 27th, 28th, 29th.

Solar halos were also observed at the following stations not included in the districts named above:

California.—San Francisco, 10th, 21st, 24th, 27th to 30th.

Florida.—Key West, 25th, 27th; Pensacola, 12th, 24th.

Idaho.—Fort Lapwai, 14th.

Illinois.—Anna, 28th; Cairo, 4th; Riley, 6th, 19th.

Indiana.—Vevay, 29th; Wabash, 5th.

Iowa.—Keokuk, 7th.

Kansas.—Fort Scott, 27th.

Michigan.—Alpena, 29th; Grand Haven, 27th.

Minnesota.—Saint Vincent, 24th.

Mississippi.—Vicksburg, 19th.

Ohio.—Columbus, 12th.

Texas.—Fort Stockton, 18th.

Utah.—Nephi, 16th; Salt Lake City, 11th, 24th.

Washington Territory.—Dayton, 8th; Fort Canby, 16th.

LUNAR HALOS.

Lunar halos have been observed in the various districts on the following dates:

New England.—10th to 14th, 16th, 19th, 20th, 22d.

Middle Atlantic states.—9th to 14th, 16th to 22d.

South Atlantic states.—10th, 12th, 14th, 17th, 18th, 19th.

Eastern Gulf.—8th, 12th, 15th, 16th, 19th.

Western Gulf.—9th to 20th.

Tennessee.—10th, 12th, 14th, 16th, 19th.

Ohio valley.—10th, 12th, 13th, 16th.

Lower lakes.—11th to 14th, 17th to 20th.

Upper lakes.—11th to 17th, 19th.

Upper Mississippi valley.—7th, 14th, 15th.

Missouri valley.—9th, 10th, 12th, 13th, 14th, 19th.

Lunar halos were also observed at the following stations, not included in the districts named above:

Arizona.—Prescott, 10th.

California.—San Francisco, 15th.

Colorado.—West Las Animas, 9th.

Dakota.—Bismarek, 17th; Fort Totten, 28th.

Florida.—Sanford, 14th, 15th.

Kansas.—Salina, 14th; Yates Centre, 9th.

Nebraska.—North Platte, 14th.

Ohio.—Columbus, 18th.

Oregon.—Albany, 15th.

Pennsylvania.—Pittsburg, 11th.

Texas.—Brownsville, 17th; Fort Concho, 17th; Fort Stockton, 11th.

Utah.—Nephi, 16th.

Washington Territory.—Fort Canby, 10th.

MIRAGE.

Block Island, Rhode Island, 26th.—The main land at Point Judith was visible to-day from 7 a. m. to 4.30 p. m.

Salina, Kansas, 19th, 24th, 28th.

Indianola, Texas, 16th, 23d, 24th.

MISCELLANEOUS PHENOMENA.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and forty-one stations show 4,203 observations to have been made, of which three were reported doubtful; of the remainder, 4,200, there were 3,660, or 87.2 per cent., followed by the expected weather.

SUN SPOTS.

The following record of sun spots for the month of September, 1883, has been forwarded by Professor D. P. Todd, Director of the Lawrence observatory, Amherst, Massachusetts:

Date— Sept., 1883.	No. of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 8 a. m.	1	20†	0	10†	1	3	7	95†	
2, 9 a. m.	1	10†	2	5	1	5	6	80†	
3, 10 a. m.	1	3	0	10†	1	1	7	55†	
4, 10 a. m.	1	1	1	5	1	1	7	40†	
5, 9 p. m.	0	0	1	4	0	0	5	30†	
6, 5 p. m.	0	0	0	5	0	0	5	20†	
9, 10 a. m.	1	6			1	6	0	20†	One of the spots very large.
10, 4 p. m.	2	13†		2	1	3	6	30†	Do.
11, 4 p. m.	0	10†	1	3	0	2	5	35†	Do.
15, 12 m.	3	15†					6	50†	
16, 10 a. m.	0	0		3	0	0	5	45†	
18, 5 p. m.	0	0			0	0	5	25†	Broad areas of facule.
19, 11 a. m.	0	0	0	5	0	0	4	20†	
21, 4 p. m.	0	0	2	10†	0	0	2	10†	Veiled spots.
22, 11 a. m.	1	3	0	3	0	0	2	10†	Do.
25, 3 p. m.	0	0			0	0	0	0	
26, 11 a. m.	3	8	0	0	1	2	3	8	Do.
27, 3 p. m.	0	0	0	0	0	0	2	6	Do.

Facule were seen at the time of every observation. † Approximated.

Mr. William Dawson, of Spiceland, Indiana, reports having observed sun spots during September, as follows:

1st.—Seven groups, ninety spots; one group of six prominent spots, three of which were quite large, appeared in the southeast quadrant.

3d.—Eight groups, sixty-six spots; one spot 9,000 miles long and 6,500 miles wide was faintly visible to the naked eye.

5th.—Six groups, sixty spots; the large spot observed on the 3d appeared much broken.

10th.—Five groups, fifty spots; one of which was visible to the naked eye.

13th.—The large spot seen on the 10th was still plainly visible without the telescope.

14th.—Six groups, eighty spots; the large spot before mentioned was much broken on this date, but it was still visible to the naked eye.

19th.—Four groups, forty spots.

21st.—Two groups, seventeen spots, fourteen of which were near the western edge.

24th.—Three groups, seven small spots.

26th.—Two groups, seven spots; one large spot at east edge.

28th.—Four groups, seventeen spots.

29th.—Five groups, twenty-two spots, all of which, with one exception, were very small.

Mr. H. D. Goway, at North Lewisburg, Ohio, reports that sun spots were observed at that place on all clear days during the month.

The s. s. "Hevelius," on the 10th and 11th, at Bahia, Brazil, and from the 12th in S. 11° 00', W. 35° 30', to the 21st, in N. 27° 07', W. 21° 30'; observed daily a large spot on the sun, which disappeared on the last-named date.

The s. s. "Llandaff City" observed sun spots, as follows: